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An analysis of Published Process-Product Research on Physical Education Teaching Methods

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Abstract

The purpose of this study was to identify, categorize, and analyze published process-product research on physical education teaching methods completed between 1960 and 2009. A literature search utilizing electronic databases yielded 138 studies which met the criteria for inclusion in the analysis. Each study was analyzed to obtain information on (a) the decade the study was published, (b) the number of authors, (c) the publication outlet, (d) the type of class, (e) the sampling method, (f) the effect size, (g) the statistics used, and (h) the statistical assumptions. The results indicated that most studies were the result of collaboration efforts among researchers. Also, intact classes rather than randomization was the most common technique used for forming the experimental groups. In the majority of the studies, the selection of the sample was done by means of purposive sampling techniques. A large proportion of the studies used univariate statistics to complete the data analysis. However, the majority of the papers reviewed did not report effect size values nor did they report fulfilment of certain statistical assumptions. The major publication outlet for process-product research was the Journal of Teaching in Physical Education.

Key Words: process-product research, physical education, content analysis

Introduction

According to Silverman & Ennis (1996) research on physical education (PE) pedagogy focuses on three areas: teaching, teacher education, and curriculum. Curriculum research examines the subject matter taught and the many factors that influence the content of physical education. Teacher education research focuses on teacher training and development from pre-service to retirement. For the most part,

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research on teaching is based on Dunkin & Biddle's (1974) model for the study of teaching. This model has been used to examine relationships between variables in the teaching-learning process (i.e., presage, context, process, and product variables) (Rink, 1993). More specifically, the majority of research on teaching in physical education (RT-PE) falls within the process-product paradigm on teaching methods (see Silverman & Skonie, 1997; Silverman & Manson, 2003; for discussion). Process variables refer to the actual activities of classroom teaching (all the observable behaviours of teachers and students). Product variables refer to changes that come about in students as a result of their participation in classroom activities with teachers and other students (Dunkin & Biddle, 1974).

Examples of process variables in PE are the time students spend doing tasks as well as characteristics of teaching behaviors (e.g., efforts to individualize, directions, and evaluation). Examples of product variables are psychomotor, affective, or cognitive outcomes which can be long term or short term (Rink, 1993). In process-product research on teaching methods, much emphasis is placed upon determining the relationship between teacher behavior and student achievement (Rink, 1996).

According to Silverman & Skonie (1997), one way to understand the prosperity and growth of research in an area is to analyze its research. Content analysis is a research tool used to determine the presence of certain words or concepts within a text. Researchers quantify and analyze the presence, meanings, and relationships of such words and concepts, then make inferences about the messages within the text (Riffe et al., 2005). To conduct a content analysis, the text is coded or broken down into manageable categories on a variety of factors (e.g., research focus, design, population, method, and variables used). This type of analysis allows for gathering information and drawing conclusions about those factors (Silverman & Skonie, 1997). Moreover, content analysis can provide directions for future studies and for planning research. It should be noted that analysis of research is different from literature review in that content analysis categorizes research while literature review synthesizes the results.

Content analysis is a common practice in several fields such as environmental education (Bammel et al., 1988), mass communication (DuPagne et al., 1993), coaching (Gilbert & Trudel, 2004), sport management (Smucker & Grappendorf, 2004), special education (Swanson, 1993), psychology (Todd et al., 1994), and adapted physical activity (Zhang & deLisle, 2006). In PE there have been a few analyses of published or dissertation RT-PE. Silverman (1987) found that most dissertation research on teaching was quantitative and focused on comparisons between teaching methods. Also, dissertation research occurred in school settings, did not utilize any systematic observation, and used some form of univariate statistics for data analysis. Silverman & Manson's (2003) study provided 15 years of follow-up to Silverman's (1987) study and found similar results. When published research was analyzed (Silverman & Skonie, 1997) the results revealed that most studies were categorized as process-product research on teaching methods, used an observation instrument to collect data, and employed intact classes.

In an analysis of research on the Spectrum of Teaching Styles (Mosston & Ashworth, 2008), Chatoupis (2010) found that Spectrum research has increased in number over the years and focused mainly on the psychomotor domain. In addition, Chatoupis found that Spectrum research used teaching styles from the Reproduction cluster[1] most frequently and was quantitative. Finally, Kulinna, Fletcher, Kodish, Phillips, and Silverman (2009) provided a detailed analysis of the research literature in PE for a decade (1995-2004). They found that the majority of papers represented the area of teaching, research in PE pedagogy has increased since 1995, and the number of authors ranged from one to 10.

The main purpose of this study was to identify, categorize, and analyze process product research on PE teaching methods. This study builds upon the previous work of Silverman & Skonie (1997) and Silverman & Manson (2003) by providing a global examination of process-product research on PE teaching methods across certain categories. The authors selected that area of teacher effectiveness to analyze because (a) Process-product research on PE teaching methods addresses practical issues in education settings and focuses on factors that are related to effective teaching and (b) Although research on PE teaching methods has been analyzed in unison with other areas of teacher effectiveness (Silverman & Skonie, 1997; Silverman & Manson, 2003), no study has exclusively focused on analyzing process-product research on PE teaching methods. The present analysis of process-product research will provide researchers with insights into research trends and directions for planning process-product research. Also, it will show the progress of the field and will serve as a resource for those conducting research in the field. In addition, the results of this study will (a) serve as critical considerations in the design of process-product research and (b) show areas of omission of process-product research on which investigators should concentrate. Without a systematic analysis of the volume of research on teaching, it is difficult for the researchers to stay current of the evolving database.

Methods

The focus of this paper was on process-product research on PE teaching methods. This type of research includes studies which focus on the effects of one or more teaching methods on learning outcomes. The design of the present analysis was based on a previous analysis of RT-PE (i.e., Silverman & Skonie, 1997).

Identifying Research

The authors undertook a literature search utilizing electronic databases (ERIC, Sport Discus, ISI Web of Science). The search used specific keywords (e.g., *teaching methods, physical education*) to identify all data-based English language research completed from 1960 to December 2009, inclusive. Only research papers in journals were investigated because the publication of research in a journal includes a peer review process and that suggests a more unbiased, professional investigation and presentation. Conference proceedings and other unpublished papers were not included in the study.

Initially, the authors reviewed paper titles and abstracts to decide which studies met the inclusion criteria (process-product research on PE teaching methods, English language, journal article, 1960-2009). This resulted in 138 studies[2] meeting the criteria. To determine reliability of article inclusion the leading author and an expert on the field re-reviewed them. To calculate inter-coder reliability *Scott's Pi coefficient of reliability* was used (van der Mars, 1989). Inter-coder agreement for the two sets of decisions was estimated to be 92%. The formula for determining reliability is as follows:

$$\%R = n \text{ agreements}/(n \text{ agreements} + n \text{ disagreements}) \times 100$$

Categorizing Research

Specific categories were determined based on previous research analyses in PE (Silverman & Skonie, 1997; Silverman & Manson, 2003). The draft with the initial categories was piloted coded on 50 randomly selected papers to make sure that the instrument was usable. As a result, some coding categories were not used at all, others were modified, new ones were added and the instrument was finalized. All categories and subcategories are listed in <Figure 1>.

Analysis of Research on Teaching Methods

- Decade
  - 1960-1969
  - 1970-1979
  - 1980-1989
  - 1990-1999
  - 2000-2009
- Publication outlet
  - JTPE
  - RQES
  - The PE
  - P & MSs
  - IJPE
  - EPER
  - Various
- Number of Authors
  - Single
  - Multiple
- Type of class
  - Random
  - Intact
- Sampling method
  - Purposive
  - Random
- Effect size
  - Yes/No
- Statistics used
  - Descriptive
  - Univariate
  - Multivariate
  - Other
- Statistical assumptions
  - Yes
  - No

Figure 1. Coding categories for process-product research studies.

Decade the Study was Published

The years between 1960 and 2009 were delineated into 10-year periods for comparison across time. The decade 1960-1969 included the years from 1964 to 1969 because no research was traced prior 1964.

Publication Outlet

This category included the journals in which the 138 studies appeared. The coding sheet listed the most popular journals based on the number of studies published (e.g., *Journal of Sport and Exercise Psychology, Journal of Sport Psychology, European Journal of Sport Science, the Sport Psychologist, Studies in Physical Culture and Tourism, International Journal of Sport Science, the Journal of Social Psychology, Journal of Sport Sciences, Physical Education and Sport Pedagogy, Sport Education and Society*). Journals which published less than five studies were included in the subcategory entitled *Various.*

Number of Authors

The number of authors included two subcategories: single author (studies completed by one author) and multiple authors (studies completed by two or more authors).

Type of Class

The type of class was coded. For example, if a study did not randomly assign individuals to the various treatments, then *intact* class was coded. On the contrary, if a study employed random assignment of individuals, then *random* was coded.

Sampling Method

All studies specified sample designs of research. Therefore, the sampling method was coded either as *purposive or random.*

Whether Effect Size (ES) was Reported

Two subcategories were coded: yes, if ES was reported and no, if ES was not reported.

Statistics Used

Statistics were categorized as (a) descriptive, (b) univariate, (c) multivariate, and (d) other. The *Descriptive* subcategory included statistics such as *M, SD, f,* or %. The *Univariate* subcategory coded studies that used t-test, ANOVA, or ANCOVA. The *Multivariate* subcategory designated multivariate statistics such as MANOVA, MANCOVA, or multiple regression (correlation/predictive). Finally, the fourth subcategory, entitled other, included studies that used qualitative methods of data collection. If multiple statistical methods were employed in a study, the statistic that addressed the main goal of the research was coded.

Statistical Assumptions

This category coded studies that did or did not report certain statistical assumptions (e.g., normality, homogeneity of variance, linearity, multicollinearity). For studies that did not report statistical assumptions, it was not possible to say if some or no statistical assumptions were tested.

Each study was categorized on each of the above dimensions. Prior to actual coding, coding reliability was determined by randomly selecting 30 papers and recoding them. The percentage of agreement for each category and for all categories combined was 90% and 85%, respectively.

Data Analysis

All studies were analyzed for each category to provide summary information. In particular, statistical analysis provided frequencies, percentages, and cumulative percentages for each category. One-way and two-way frequency tables were compiled for selected pairs of categorical variables. Means and other statistics were calculated for the continuous variables. The SPSS (version 16.0) was used for all analyses.

Results

Decade of Publication

Between 1964 and 2009, a total of 138 research papers that focus on process-product research on PE teaching methods were published. According to <Table 1>, the number of studies has grown steadily since the 1960s. This is evidenced by the fact that almost 60% of the studies have been published over the last two decades. The greatest number of papers was 49 published in the 2000s whereas the fewest number was published in the 1960s (7, 5.9%).

Table 1. Trends by decade of publication.

Decade	Number of studies f	Percentage of total %f	Cumulative Percent c%f
1960-1969	7	5.9	5.9
1970-1979	10	7.2	12.3
1980-1989	33	23.9	36.2
1990-1999	39	28.3	64.5
2000-2009[a]	49	35.5	100.0
Total	138	100.0	

[a]2009 data is included for the whole year.

Publication Outlet

The *Journal of Teaching in Physical Education* (JTPE) published the most papers (35, 25.4%) followed by the *Research Quarterly for Exercise and Sport* (22, 15.9%) and the *Physical Educator* (15, 10.9%). These three journals published about 52.2% of the papers. Also, a wide range of other education/sport journals (i.e., 25) served as outlets for another 37 papers. A list of the most popular journals is given on <Table 2>.

Table 2. Publication outlet.

Decade	Number of studies f	Percentage of total %f
JTPE	35	25.4
RQES	22	15.9
The PE	15	10.9
P & MSs	15	10.9
EPER	8	5.8
IJPE	6	4.3
Various	37	26.8
Total	138	100.0

Note. JTPE = Journal of Teaching in Physical Education; RQES = Research Quarterly for Exercise and Sports; The PE = The Physical Educator; P & MSs = Perceptual and Motor Skills; EPER = European Physical Education Review; IJPE = International Journal of Physical Education.

Number of Authors

Single authors published 25 papers (18.1%) whereas multiple authors published 113 papers (81.9%). Single-authored papers did not increase over time whereas multiple-authored papers increased tremendously in number across decades. The mean number of authors was 2.44 (*SD*=1.20) and the mode was 2. Table 3 shows the number of authors classified by decade of publication.

Table 3. Number of authors by decade.

Decade	Single author		Multiple author	
	f	c%f	%f	c%f
1960-1969	3 (2.2)	2.2	4 (2.9)	2.9
1970-1979	2 (1.4)	3.6	8 (5.8)	8.7
1980-1989	8 (5.8)	9.4	25 (18.1)	26.8
1990-1999	7 (5.1)	14.5	32 (23.2)	50.0
2000-2009	5 (3.6)	18.1	44 (31.9)	81.9
Total	25 (18.1)		113 (81.9)	

Note. Values enclosed in parentheses represent percentages.

Type of Class

Intact classes were used by 61 studies (44.2%) as opposed to randomly assigning students to classes (69 studies, 49%). In eight studies (5.8%) the research design was not described.

Sampling Method

In 16 studies random sampling was used whereas in the majority of the studies (121, 87.7%) purposive or convenient sampling was the sample design of research. In one study the sampling method was not specified.

ES

Although the number of studies that reported ES increased over the decades, the majority of the reviewed studies did not report ES at all (115, 83.3%). Unlike the first two decades in which the number of studies that did not report ES was relatively small, in the last three decades a rather high percentage of the studies did not report ES. Table 4 provides a complete breakdown of the ES category and the decade of publication category.

Table 4. Effect size by decade.

Decade	Reported		Not reported	
	f	c%f	%f	c%f
1960-1969	0 (0.0)	0.0	7 (5.1)	5.1
1970-1979	0 (0.0)	0.0	10 (7.2)	12.3
1980-1989	1 (0.7)	0.7	32 (23.2)	35.5
1990-1999	9 (6.5)	7.2	30 (21.7)	57.2
2000-2009	13 (9.4)	16.6	36 (26.1)	83.3
Total	23 (16.7)		115 (83.3)	

Note. Values enclosed in parentheses represent percentages.

Statistics Used

Some form of univariate statistics was employed most frequently (68.1%). In particular, 40 studies (29%) used ANOVA or ANOVA with repeated measures andanother 26 studies (18.8%) used ANCOVA or ANCOVA with repeated measures. Multivariate statistics were used quite frequently (37, 26.8%). Table 5 shows the statistics reported in full detail.

Table 5. Statistics used.

Statistics	Number of studies	Total percentage
	f	%f
Descriptive	12	9.4
Univariate stats	94	68.1
T test	21	15.2
ANOVA/ANOVA RM	40	29.0
ANCOVA/ANCOVA RM	26	18.8
Multivariate stats	37	26.8
MANOVA/MANOVA RM	30	21.7
Multiple regression	7	5.1
Other (qualitative)	2	1.4
Total	138	100.0

Note. Values enclosed in parentheses represent percentages

Statistical Assumptions

The majority of the studies (125, 90.6%) did not report whether or not certain statistical assumptions were met. The very few studies that reported statistical assumptions mainly focused on testing homogeneity of variance, linearity of data, and multicolinearity.

Discussion

It is apparent from <Table 1> that the number of studies has gradually increased since the 1960s. This growing trend in process-product research reveals that the field is still vibrant and draws the attention of the pedagogical community. This is in line with previous analyses of RT-PE research (Kulinna et al., 2009; Silverman, 1987; Silverman & Skonie, 1997; Silverman & Manson, 2003). Given that process-product research on PE teaching methods addresses practical issues and focuses on student learning, the above result makes sense. However, sustained process-product research should continue. It is notable that in the 1960s only seven studies were traced. A possible reason for that is that the number of pedagogy-focused journals or the number of pedagogy researchers was small at that time.

<Table 2> shows that the JTPE is the major publication outlet for process-product research. This result is consistent with other content analyses (Kulinna et al., 2009; Silverman & Skonie, 1997). Although there is a wide range of sport/pedagogy journals, it seems that authors prefer submitting their work to the above journal. This is probably due to the fact that the JTPE, as a nonpartisan journal, accepts diverse papers that are grounded on different methodologies and varied epistemological foci (Ward & Ko, 2006).

Also, it was found that quite a few different academic journals publish process-product research on PE teaching methods (see Table 2). This is heartening as it seems that there is a broad variety of journals to choose from when submitting manuscripts. In addition to that, all these diverse journals serve different fields (psychology, sociology, pedagogy) which results in investigating the process-product research paradigm from different perspectives.

According to <Table 3>, not only did the multiple-authored papers outnumber the single-authored ones but they also increased over the decades and especially in the last three decades (1979-2009). Kulinna et al. (2009) found that the mean number of authors on PE pedagogy papers is 2.20, which is close to the present finding (M = 2.44). Collaboration efforts are obvious not only in sport pedagogy papers but also in health and medicine (Kulinna et al., 2009), in sport management (Smucker & Grappendorf, 2008), and in adapted physical activity (Zhang et al., 2006). The advantages of collaboration are well known and have been highlighted elsewhere (Daprano et al., 2005). Therefore, publishing in refereed journals as a prerequisite for taking a position or a promotion in research-oriented higher education institutions necessitates collaboration between or among faculty members. Moreover, conducting experimental research to investigate the effectiveness of disparate teaching methods is a demanding task which stresses the need for collaboration.

Like Silverman & Skonnie's (1997) study, several of the reviewed studies (44.2%) did not use an equivalent control group design (i.e., random assignment). In many of these instances researchers were not concerned about the extent to which their study establishes that the teaching methods in use have actually caused the effect that is found (internal validity). An equivalent control group design is considered a very valid scientific approach to the investigation of research problems. Its big advantage is the tight control it exercises on the threats to the internal validity (Gall et al., 1996). However, in many cases, well-controlled experiments and controlled groups are not easy to achieve (Griffey, 1981; Silverman & Solmon, 1998; Thomas & Nelson, 2001). For example, much of the reviewed process-product research occurred in school settings where membership of the class is usually predetermined and researchers must operate under existing conditions.

Most research (87.7%) utilized purposive or convenient sampling techniques making it almost impossible to generalize the results from the sample to the population (Gall et al., 1996). It seems that because the reviewed studies were conducted in school settings random sampling techniques were difficult to use. Research that is real world or field oriented does not allow for random sampling of individuals (Robson, 1996; Thomas & Nelson, 2001). For example, the choice of schools is usually made on the basis of the schools' availability and on the good will of the teaching personnel. Principals do not want researchers to interfere in the time table of the school and the busy schedule of the teachers. In addition, random samples are expensive and difficult to come by (Kerlinger, 1992). In any case, generalizability of the results is in jeopardy.

It is apparent from <Table 4> that most papers (83.3%) did not report ES. Unfortunately, scholarship's call to report ES (Griffey, 1981; Franks & Huck, 1986; McBride & Xiang, 2009; Thomas et al., 1991) is not heard by the pedagogical community. Reporting ES is valuable and necessary for (a) meaningful summarization of studies in meta-analyses (Griffey, 1981), (b) assessing the magnitude of the observed effect and interpreting the significance of the results (American Psychological Association, 2010; Thomas et al., 1991), and (c) planning sample sizes that allow real differences among groups (Thomas et al., 1997).

Speaking of statistical tests, testing of means was the prevalent form of statistical analysis which is consistent with a previous result (Silverman & Manson, 2003). In particular, 94 of the 138 studies used univariate statistical analysis. Similarly, Silverman (1987) found that the majority of RT-PE in doctoral programs used t-test or ANOVA. Given that all the reviewed studies focused on teaching methods comparisons, the use of the above analyses makes sense. On a positive note all studies reported means and variances which is valuable for understanding and summarizing data (Griffey, 1981). It is not surprising that ANCOVA was used in quite a few cases (18.8%) as intact classes were employed in many studies. When random assignment is not possible and the researchers end up with intact groups, ANCOVA is usually suggested (Reichardt, 1979; Tabachnick & Fidell, 2007).

In some instances t-tests were used when ANOVA would be more appropriate. The option of using t-test when there are more than two treatment groups increases the probability of Type I error (Silverman, 1985). In most cases of multiple dependent variables MANOVA was used. However, MANOVA should not be used in all instances where there are multiple dependent variables (Silverman, 1985). For example, MANOVA is valid when the intercorrelations among the dependent variables are moderate (Finn & Mattsson, 1978; Meyers et al., 2006). When correlations are high, multicolinearity ensues and, thus, MANOVA should be avoided. In the absence of significant correlations, the use of separate ANOVAs is recommended.

Testing for proper statistical assumptions was reported by only 13 (9.4%) of the 138 studies. This is consistent with previous studies which reported that most pedagogy researchers in PE (Chen & Zhu, 2001; Griffey, 1981) or in other fields

(Keselmen et al., 1998) overlook fulfillment of statistical assumptions. It is important that at least the basic assumptions should be tested (i.e., normality, homogeneity of variance, and linearity of data) because, otherwise, the validity of the results is in jeopardy.

In conclusion, the field of process-product research on PE teaching methods has expanded since the 1960s. Most research in the area is the result of collaboration efforts and is published in a wide range of scholarly journals. Unfortunately, the data from this study shows that in some cases investigators are still using research designs and statistical procedures that are not always appropriate. Therefore, investigators should have a good command of research methodology and statistics and know how to report their research.

In particular, randomization in experimental designs is suggested as the soundest approach to controlling extraneous variables; that is randomly assigning participants to groups (Field & Hole, 2006). Although other methods of controlling extraneous variables have been suggested (e.g., matching, comparing homogeneous groups, or using participants as their own control) (Gay, 1976), random assignment is strongly advised for use in experimental designs.

Using statistics that are appropriate from a research design viewpoint is of utmost importance. Silverman and Solmon (1998) suggest that the simplest analysis that can complement the design of the research should be selected by the researcher. For example, ANCOVA or discriminant analysis has been suggested to analyze data from non-equivalent control group designs (Morris, 1983).

Conducting statistical analyses without testing certain statistical assumptions is problematic (Huck, 2000). When the assumptions are not reported in a paper, the reader cannot judge the validity of the results. Not only should researchers be knowledgeable about the statistical procedures they are using but they should also be aware of and test the assumptions associated with these procedures (Silverman & Solmon, 1998). For a summary of available methods to test and address the violations of certain assumptions, the interested reader is referred to Chen and Zhu (2001).

Finally, reporting ES has been recommended by many scholars (Frohlich et al., 2009; McBride & Xiang, 2009; Thompson, 2009) as well as by the American Psychological Association (2010). Interpretation of statistical analyses is enhanced by reporting the magnitude of relations between dependent and independent variables. Not only should the authors report whether the effects are significant but they should also indicate if the effects are meaningful according to established criteria (i.e., Cohen, 1988).

The present content analysis focused on certain categories. Future content analysis on process product research should include other categories such as whether observation instruments were used, student variable measured, sample size, population (e.g., elementary or high school), research focus and methods of data collection (e.g., questionnaire, interview, systematic observation, motor skill tests). In addition, apart from journals, further research using other data sources such as dissertation abstracts or conference proceedings is needed. Moreover, it would be interesting to investigate not only the number of authors, as the present study did, but also the gender of the first author (e.g., see Ward & Ko, 2006). Furthermore, tracing authorship from all over the world is important in reaching conclusions about the spread of process-product research knowledge globally. Thus, the country of origin is another category that is worth investigating in any future content analysis. Also, together with the ES values it is imperative to examine if process product research reports the obtained magnitude or value of the test statistic, the degrees of freedom, the exact p value, and the confidence intervals. All this information "helps the reader fully understand the analyses conducted and possible alternative explanations for the outcomes of those analyses" (American Psychological Association, 2010, p. 31). Finally, apart from using descriptive statistics such as means and frequencies to report results in content analysis, it is advisable to employ more advanced statistics (e.g., linear regression) (see Zhang et al., 2006) to fully explore trends in process product research. Content analysis studies will provide us with a more complete picture of the trends in process product research and complement our knowledge on the progress of the field.

References

American Psychological Association (2010). *Publication manual for the American psychological association* (6th ed.). Washington DC: American Psychological Association.

Bammel, L. L., Bammel, G., & Kopitsky, K. (1988). Content analysis: A technique for measuring attitudes expressed in environmental education literature. *Journal of Environmental Education*, **19(4)**, 32-37.

Chatoupis, C. (2010). An analysis of spectrum research on teaching. *The Physical Educator*, **67(4)**, 188-197.

Chen, A., & Zhu, W. (2001). Revisiting the assumptions for inferential statistical analyses: A conceptual guide. *Quest*, **53**, 418-439.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* New York : Academic.

Dunkin, M. J., & Biddle, B. J. (1974). *The study of teaching.* New York : Holt, Rinehart, and Winston.

DuPagne, M., Potter, W. J., & Cooper, R. (1993). A content analysis of women's published mass communications research, 1965-1989. *Journalism Quarterly*, **70**, 815-823.

Field, A., & Hole, G. (2006). *How to design and report experiments.* London: Sage Publications.

Finn, J. D., & Mattsson, I. (1978). *Multivariate analysis in educational research.* Chicago : National Educational Resources.

Franks, B D., & Huck, S. W. (1986). Why does everyone use the .05 significance level? *Research Quarterly for Exercise and Sport*, **57(3)**, 245-249.

Frohlich, M., Emrich, E., Pieter, A., & Stark, R. (2009). Outcome effects and effects sizes in sport sciences. *International Journal of Sports Science and Engineering*, **3(3)**, 175-179.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction* (6th ed.). White Plains, NY : Longman.

Gay, L. R. (1976). *Educational research. Competencies for analysis and application.* Columbus Ohio: Charles Merrill.

Gilbert, W. D., & Trudel, P. (2004). Analysis of coaching science research published from 1970-2001. *Research Quarterly for Exercise and Sport*, **75(4)**, 388-399.

Griffey, D. C. (1981). What is the best way to teach? *Journal of Teaching in Physical Education*, **1**, 18-24.

Huck, S. W. (2000). *Reading statistics and research* (3rd ed.). New York : Longman.

Kerlinger, F. N. (1992). *Foundations of behavioural research.* New York : Holt, Rinehart, and Winston.

Keselman, H. J., Huberty, C. J., Lix, L. M., Olejnik, S., Cribbie, R. A., Donahue, B., Kowalchuk, R. K., Lowman, L. L., Petoskey, M. D., Keselman, J. C., & Levin, J. R. (1998). Statistical practices of educational researchers: An analysis of their ANOVA, MANOVA, and ANCOVA analyses. *Review of Educational Research*, **68**, 350-386.

Kulinna, P. H., Scrabis-Fletcher, K., Kodish, S., Phillips, S., & Silverman, S. (2009). A Decade of research literature in physical education pedagogy. *Journal of Teaching in Physical Education*, **28**, 119-140.

McBride, R., & Xiang P. (2009). Reporting effect size. *Journal of Teaching in Physical Education*, **28**, 115-118.

Meyers, L., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and* *interpretation.* London : Sage Publ. Inc.

Morris, H. H. (1983). Quasi experimentation and discriminant analysis in research on teaching in physical education. In T. J. Templin & J. K. Olson (Eds.), *Teaching in physical education* (pp. 329-338). Champaign IL: Human Kinetics.

Mosston, M., & Ashworth, S. (2008). *Teaching physical education* (1st online ed.). Retrieved January 3, 2009, from http://www.spectrumofteachingstyles.org/ebook

Reichardt, C. S. (1979). The statistical analysis of data from nonequivalent group designs. In T. D. Cook & D. T. Campbell (Eds.), *Quasi-Experimentation. Design and analysis issues for field settings* (pp. 147-201). Chicago : Rand McNally.

Rife, D., Lacy, S., & Fico, F. G. (2005). *Analyzing media messages: Using quantitative content analysis in research* (2nd ed.). Mahwah, NJ : Lawrence Erlbaum.

Rink, J. E. (1993). *Teaching physical education for learning.* Mosby-Year Book.

Rink, J. E. (1996). Effective instruction in physical education. In S. J. Silverman & C. D. Ennis (Eds), *Student learning in physical education. Applying research to enhance instruction* (pp. 171-198). Champaign IL : Human Kinetics.

Robson, C. (1996). *Real world research.* Oxford : Blackwell Publishers.

Silverman, S. (1985). Critical considerations in the design and analysis of teacher effectiveness research in physical education. *International Journal of Physical Education*, **22(4)**, 17-24.

Silverman, S. (1987). Trends and analysis of research on teaching in doctoral programs. *Journal of Teaching in Physical Education*, **7**, 61-70.

Silverman, S., & Ennis, C. (1996). Enhancing learning: An introduction. In S. Silverman & C. Ennis (Eds.), *Student learning in physical education: Applying research to enhance instruction*(pp. 3-8). Champaign, IL : Human Kinetics.

Silverman, S., & Manson, M. (2003). Research teaching in physical education doctoral dissertation: A detailed investigation of focus, method, and analysis. *Journal of Teaching in Physical Education*, **22**, 280-297.

Silverman, S., & Skonie, R. (1997). Research on teaching in physical education: An analysis of published research. *Journal of Teaching in Physical Education*, **16**, 300-311.

Silverman, S., & Solmon, M. (1998). The unit of analysis in the field research: Issues and approaches to design and data analysis. *Journal of Teaching in Physical Education*, **17**, 270-284.

Smucker, M., & Grappendorf, H. (2004). A Content analysis of sport management faculty collaboration: Single versus multiple authorship. *The SMART Journal,* **75(4)**, 47-57.

Swanson, H. L. (1993). Selecting a research program in special education: Some advice and generalizations from published research. *Remedial and Special Education*, **14(3)**, 7-10.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). New York : Pearson International Edition.

Thomas, J. R., & Nelson, J. K. (2001). *Research methods in physical activity* (4th ed.). Champaign, IL : Human Kinetics.

Thomas, J. R., Lochbaum, M .R., Landers, D. M., & He,C. (1997). Planning significant and meaningful research in exercise science: Estimating sample size. *Research Quarterly for Exercise and Sport*, **68(1)**, 33-43.

Thomas, J. R., Salazar, W., & Landers, D. M. (1991). What is missing in p<.05? Effect size. *Research Quarterly for Exercise and Sport*, **62(3)**, 344-348.

Thompson, B. (2009). A brief primer on effect sizes. *Journal of Teaching in Physical Education*, **28**, 251-254.

Todd, D. E. M., Kurcias, J., & Gloster, K. (1994). Review of research conducted in psychology program training clinics. *Professional Psychology: Research and Practice*, **25**, 471-481.

Van der Mars, H. (1989). Observer reliability: Issues and procedures. In P. W. Darst, D. B. Sakrajsek, & V. H. Mancini (Eds), *Analyzing physical education and sport instruction* (pp. 53-80). Champaign IL : Human Kinetics.

Ward, P., & Bomna, K. (2006). Publication trends in the Journal of Teaching in Physical Education from 1981 to 2005. *Journal of Teaching in Physical Education*, **25**, 266-280.

Zhang, J., & deLisle, L. (2006). Analysis of AAHPERD research abstracts published under special populations from 1968 to 2004. *Adapted Physical Activity Quarterly*, **23**, 203-217.

Footnote

The Reproduction cluster is more akin to direct, didactic, or teacher-centered instruction. When styles from the reproduction cluster are used the purpose of the instruction is the replication of specific known skills and knowledge. The teacher specifies the subject matter of the lessons, indicates the learning conditions by identifying the teaching style, and defines the criteria for correct task completion (Mosston & Ashworth, 2008).

A list of the reviewed papers is available from the first author.